EFFICIENCY AND VARIETY OF ATTACKING ACTIONS IN JUNIOR AND SENIOR ELITE KARATE PLAYERS' MATCH

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Abstract. *Introduction*. Karate is a combat sport vastly popular over the world, and important part of Asian Games program. Inclusion of Karate to 2020 Olympics program targeted engaging younger people in the Olympic movement. Karate thus joined judo and taekwondo as the third Olympics-approved sport in the martial arts category.

Study objective. The general objective of the study was to compare the variety and efficiency of the attacking actions in senior and junior elite karate players' match.

Methodology. Eight seniors and eight juniors' matches (total 16) were analyzed using the NACSPORT performance analysis software package. The players were participating in the finals of the world and continental karate competitions in the kumite category. Analyzed variables were divided into two groups: the variations of attacking actions (%) and the efficiency (ratio of scored attempted to attempted techniques) of the attacking actions. The data collected from this study were analyzed by using the SPSS software version 27.0 through independent t-test and Pearson Chi-square test.

Results. The statistically significant findings from this study were that among both groups, the overall variations of the attempted attacking actions were statistically different ($P < 0.05$). The efficiency of the attacking techniques however did not have any significant differences ($P > 0.05$). In other words, even though kicking techniques could help in obtaining the higher score, the chances of converting an attempt into a good and successful scoring kicking techniques aren't very high in a competitive karate fight at the highest level of competitions.

Conclusions. The result of this study might give a chance to all the karate practitioners especially to the coaches to make suitable changes to their methodology of training their athletes to give a better preparation the new generation of the juniors to successfully reach the senior performance level.

Keywords: karate, elite, players, juniors, seniors, techniques.

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ЕФЕКТИВНІСТЬ ТА РІЗНОМАНІТНІСТЬ АТАКУВАЛЬНИХ ДІЙ У ПОЄДИНКУ КАРАТИСТІВ МОЛОДШОЇ І СТАРШОЇ ЕЛІТИ

Анотація. Карате – це бойовий вид спорту, що надзвичайно популярний у всьому світі та є важливою частиною програми Азійських ігор. Включення карате до програми Олімпійських ігор 2020 спрямоване на залучення молоді до олімпійського руху. Тож карате приєдналося до дзюдо та тхеквондо як третій вид спорту, затверджений Олімпіадою в категорії бойових мистецтв.

Мета дослідження. Загальна мета дослідження – порівняти різноманітність та ефективність різноманітності атакувальних дій упродовж поєдинку елітних каратистів старшої вікової групи та юніорів.

Методологія. Вісім матчів старшої вікової категорії та вісім серед юніорів (загалом 16) проаналізовано за допомогою пакету програмного забезпечення для аналізу змагальної діяльності NACSPORT. Бійці брали участь у півфіналах та фіналі світових і континентальних змагань з карате в категорії куміте. Аналізовані змінні були розділені на дві групи: варіації атакувальних дій (%) та ефективність (співвідношення залікованих спроб до загальної кількості спроб) атакувальних дій. Дані, зібрані під час цього дослідження, проаналізовано за допомогою пакету програмного забезпечення SPSS версії 27.0 за допомогою незалежного *t*-критерію та тесту Хі-квадрат Пірсона.

Результати. Статистично значущі результати цього дослідження полягали в тому, що у двох групах загальні варіації спроб атакувальних дій були статистично різними ($P<0,05$). Однак ефективність атакувальних прийомів у порівнянні не мала істотних відмінностей ($P>0,05$). Інакше кажучи, незважаючи на те, що техніка ударів ногами може допомогти отримати вищий бал, шанси перетворити спробу на успішну заліковану техніку удару ногами не дуже високі в конкурентному бою з карате на змаганнях найвищого рівня.

Висновки. Результати цього дослідження можуть дати шанс усім, хто практикує карате, особливо тренерам, внести відповідні зміни в методику підготовки своїх спортсменів, щоб краще підготувати нове покоління юніорів для успішного досягнення елітного рівня результатів у старшій віковій групі.

Ключові слова: карате, еліта, бійці, юніори, сеньйори, техніка.

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Introduction. Karate is now predominantly a striking art which involves punching, kicking, knee strikes, elbow strikes and open hand techniques such as knife-hands, spear-hands, and palm-heel strikes [1]. Some forms of karate may also include small amounts of throws, joint locks and grappling.

Karate has a big sporting element known as Kumite. It is a weight categorized sport which is practiced among both male and female with 10 medal sets at place (5 in men and 5 in women in Kumite). The objective of Karate is to defeat your opponent by utilizing punches, kicks and throws to score points. At the end of a Karate kumite, the competitor with the most points is declared the winner. A karate match is set for 3 minutes per match for seniors and 2 minutes per match for juniors [2] and each time a point is given, the match will be stopped by the judges for a while and then will be continued again.

Performance Analysis being one of the fields of sport science uses video analysis and technology extensively to use own objectives as it requires careful information management for quality feedback to coaches and performers and systematic techniques of observation [3]. Performance Analysis is driven by a sport needs to understand and improve tactics, technique, and movement which is achieved through the delivery of real- and lapsed-time objective feedback. Performance analysis in sport is essentially informing the athlete and coaches what are the actual things happening as opposed to what they perceive to be happening.

Although performance analysis is quite popular in combats sports, karate is less studied among other combat sports. Most of the research in karate was primarily dedicated to the senior athletes. Limited studies were done targeting junior athletes and their performance structure and technical skills, with particularly analyzing their chances and ways of becoming equally successful seniors close to zero.

Many studies on performance analysis had been done to analyze the efficiency of the karate techniques. One research [4] was attempted on situational, technical-tactical indicators of top-level, male karate competitors based on the scored techniques. Apart from these indicators, a karate fight also consists of numbers of technical-tactical activities, such as body movement and the performed but non-scored techniques. Precisely these indicators define the energetic [5; 6], technical and tactical efficiency of the fighters [7]. Therefore, the activity of the fighters, which consists of numbers of the performed techniques, inevitably influences the fight outcome.

A study was conducted to analyze the ratio of scored and non-scored techniques to determine the difference in situational efficiency in a fight between arm and leg techniques of top-level female karate competitors [8]. The results of the research showed that there was a difference between the efficiency of arm and leg techniques. Smaller frequency of arms techniques was observed as compared to legs techniques in a karate fight because the scores obtained by leg techniques are higher. This information points to tactical justification of increased application of leg techniques as compared to arm techniques in a karate fight.

Research conducted to study the frequency and effectiveness of the arm and leg actions performed during competitions among Shotokan karate junior female athletes [9] showed conflicting outcomes. This study has shown that Shotokan karate female athletes selected for this research used arm actions more frequently than leg actions. From all arm actions performed in the fight, only 15 were effective and from 56 leg actions, only 8 were effective. However, the research showed that the efficiency of arm and leg actions were equal.

In fact, the variety of the attacking actions in karate may originate in their varied efficiency. Based on the previous studies, the efficiency of the attacking actions of different techniques depended on the types of the techniques used and the part of the body used to generate the techniques. Study shows that attacking techniques that are executed by legs are more efficient and could give more points in the match. Evolutionary, however, to date, there is no clear study that compares the differences of the techniques efficiency when executed by senior or junior elite karate players. To our information, the study about the efficiency and variety of attacking actions in senior and junior elite karate players' match and on comparison of those are still lacking.

Study objectives. The general objective of the study was to compare the variety and the efficiency of the attacking actions in senior and junior karate players' match.

The specific objectives of this study were:

- To compare the variety of attacking techniques in senior and junior elite karate players during the match.
- To compare the efficiency of the attacking techniques in senior and junior karate elite players during the match.

Methodology. Research design, setting and location. A non-experimental, cross-sectional study design was adopted in this study. This study was conducted by analyzing the video recordings of the players' matches by using a performance analysis software. The performance analysis software that was used in this study was NACSPORT (https://www.nacsport.com/index.php?lc=en-gb#) [10].

Ethical approval for the study wasn't required for the current study doesn't involve direct contact with the subjects and is purely analytic based on the available in public assess videos of the major karate tournaments.

Population, sampling and sample size. This research was targeting senior and junior karate athletes which had participated in Senior and Junior World and Continental Championships in Kumite category. According to the sample size calculations, 16 matches had been analyzed for this research (8 senior matches and 8 junior matches). The video recordings of the matches and results sheets was collected from the recent championships via International Karate Association website and/or from the video library of Malaysian National Sport Institute.

Inclusion and exclusion criteria. Inclusion criteria were top level matches (semi-finals and finals) in the World and Continental Championships in Kumite category

Exclusion criteria were not the full match has been recorded or victory before full time.

Description of variables

- Front kick (Mae geri): A front kick performed with the ball of the foot.
- Roundhouse kick (Mawashi geri): A roundhouse kick performed with either the front leg (front mawashi geri) or back leg (back mawashi geri).

• Back kick (Ushiro geri): This kick is directed backwards, keeping the kicking leg close to the standing leg and using the heel as a striking surface.

• Side thrust kick (Yoko geri (kekeomi)): A kick that is delivered sideways in thrusting motion in relation to the body of the person kicking

• Side snap kick (Yoko geri (kaege)): A kick that is delivered sideways in snapping motion in relation to the body of the person kicking.

• Back fist strike (Uraken uchi): Used as a counterattack, or as part of an aggressive combination.

• Face level punch (Jodan tsuki): Attacks targeting the head and face area.

• Middle level punch (Chudan tsuki): Attacks targeting the mid-section (abdominal, lower back and chest area) of the body.

• Downward punch (Gedan tsuki): A punch to the lower sections of the body.

• Lunge punch (Oi tsuki): A punch executed with the hand on the same side as the front foot and performed while stepping forward.

• Reverse punch (Gyaku tsuki): A punch executed with the hand on the opposite side of the front leg.

Data collection and analysis. Data collection was done after obtaining permission from the Dean of the School of Health Sciences, Universiti Sains Malaysia.

Data collected was processed by using Statistical Package for the Social Sciences (SPSS) software, version 27.0 for Windows. The collected data was analyzed descriptively and inferentially:

To compare the variety of attacking techniques of the senior and junior karate players' match and their efficiency through Chi-square test & Independent *t*- test;

To compare dynamics of the attacking actions of the senior and junior karate players' match through Independent *t*-test.

The mean and standard deviation were used as descriptive statistics for variables of variety of attacking techniques of senior and junior karate players' matches and their efficiency.

Results. Analysis of variation of attacking techniques in karate players' matches. A total of 16 matches, 8 of senior matches and 8 of junior matches were analyzed. A total number of 327 of attempts of attacking techniques has been executed in a total of 16 matches of both senior and junior karate players. All the attempts had been recorded and calculated for being used in the analysis. Listed attempts of attacking techniques were front kick, n= 38(11.62 %), roundhouse kick, n= 37(11.31 %), back kick, n= 11(3.36 %), side thrust kick, n= 42(12.84 %), side snap kick, n= 20(6.12 %), back fist strike, n=11(3.36 %), face level punch, n= 65(19.88 %), middle level punch, n=55(16.82 %), downward punch, n= 14(4.28 %), lunge punch, n=19(5.81 %), and reverse punch, n=15(4.59 %).

There was statistically significant association between the techniques and level of the karateka involvements either senior or junior, tested using Pearson Chi-Square test (χ^2 = 65.381, *p* value < 0.001). Pearson Chi-Square critical value for 10 degrees of freedom, which is 23.21 (Table 1).

Table 1

Distribution (%) of Techniques in Senior and Junior Karate Players

Variables	Variation of techniques (%)		$\chi^{2(df)}$	p value
	Seniors	Juniors		
Front kick	3.7	8.0	65.381(10)	< 0.001
Roundhouse kick	6.4	4.9		
Back kick	1.5	1.8		
Side thrust kick	10.7	2.1		
Side snap kick	5.2	0.9		
Back fist strike	2.8	0.6		
Face level punch	9.2	10.7		
Middle level punch	5.5	11.3		
Downward punch	3.7	0.6		
Lunge punch	5.2	0.6		
Reverse punch	1.2	3.4		

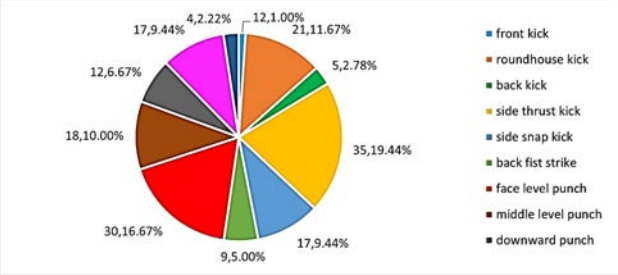

Fig. 1. Techniques variations of elite senior karate players

Based on Figure 1 and according to the results, the most attempted techniques by senior karate players were side thrust kick, n= 35 (19.44 %) followed by face level punch, n= 30 (16.67 %), roundhouse kick, n= 21 (11.67 %), middle level punch, n= 18 (10.00 %), lunge punch, n= 17 (9.44 %), side snap kick, n= 17 (9.44 %), downward punch, n= 12 (6.67 %), back fist strike, n= 9 (5.00 %), back kick, n= 5 (2.78 %), lunge punch, n= 4 (2.22 %) and lastly the least attempted techniques by the senior is front kick, n= 12 (1.00 %).

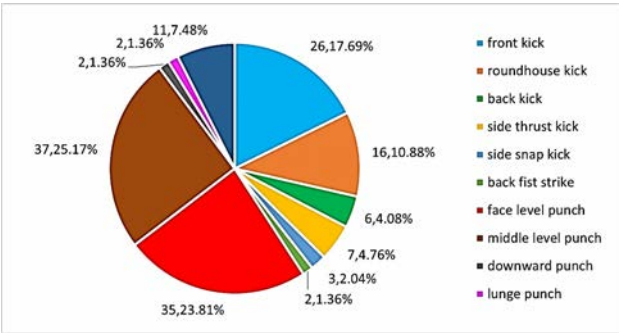

Fig. 2. Techniques variation of elite junior karate players

Based on Figure 2, and according to the results, the most attempted techniques by junior karate players were middle level punch, n= 37(25.17 %), followed by face level punch, n= 35(23.81 %), front kick, n=26(17.69 %), roundhouse kick,

n= 16(10.88 %), reverse punch, n= 11(7.48 %), side thrust kick, n= 7(4.76 %), back kick, n= 6(4.08 %), side snap kick, n= 3(2.04 %), the least attempted techniques were back fist strike, n= 2(1.36 %), downward punch, n= 2(1.36 %), lunge punch, n= 2(1.36 %), all three techniques were only attempted twice in the 8 matches.

From eleven techniques of attacking actions in karate, the junior karate players attempted five techniques; front kick (17.69 %), back kick (4.08 %), face level punch (23.81 %), middle level punch (25.1 %), and reverse punch (7.48 %) higher than the front kick (1.00 %), back kick (2.78 %), face level punch (16.67 %), middle level punch (10.00 %) and reverse punch (2.22 %) in senior players. The roundhouse kick for the senior karate players were higher which is 11.67 % when compared to junior karate players which were 10.88 %. Side thrust kick (19.44 %), side snap kick (9.44 %), back fist strike (5.00 %) downward punch (6.67 %) and lunge punch (9.44 %) were higher in percentage in senior group compared to junior group which were (4.76 %, 2.04 %, 1.35 %, 1.36 %, and 1.36 %).

Analysis of the efficiency of the attacking actions in karate players' matches. There was no significant difference between the seniors and juniors on the overall technique's efficiency from independent *t*-test (Table 2) as P>0.05.

Table 2

Overall attacking techniques efficiency (ratio of scored attempt to the frequency of the attempts)

Group	Overall techniques efficiency (Mean± SD)	t-statistic value	*P* - value
Senior	0.19 ± 0.23	1.797	0.74
Junior	0.16 ± 0.09		

The senior group showed higher efficiency of front kick, downward punch, lunge punch and reverse punch compared to the junior group. Junior group showed higher efficiency of back kick, side thrust kick and middle level punch compared to the senior group. The efficiency of roundhouse kick, side snap kick, back fist strike and face level punch were the same for both groups.

Discussion. Among the findings that we got from this study was a statistically significant ($P < 0.001$) differences between the attacking techniques of senior and junior elite karate players. The attacking techniques studied in this research were front kick, roundhouse kick, back kick, side thrust kick, side snap kick, back fist strike, face level punch, middle level punch, downward punch, lunge punch and reverse punch. In this discussion, those techniques will be categorized into two, which are kicking techniques (front kick, roundhouse kick, back kick, side thrust kick and side snap kick) and punching techniques (back fist strike, face level punch, middle level punch, downward punch, lunge punch and reverse punch).

In the senior karate players' match, the frequency of the techniques attempted were almost evenly distributed for some of the techniques that had been listed. The most attempted techniques in senior players were side thrust kick (19.44 %). While for the junior players, the side thrust kick was attempted lower in frequency (4.76 %) as compared to the seniors. The front kick was the most attempted kicking technique in the junior group. The roundhouse kick was the second frequently attempted kicking techniques for both senior (11.67 %) and junior group (10.88 %). The senior players group mostly attempted kicking techniques in the match. Foot movements form the foundation for most of the kicking and punching techniques executed during kumite championships. There was no other study found that could support that the senior players used more kicking techniques in a match. However, correct and efficient foot movements will allow karatekas to obtain the best attacking positions and evade the opponent when attacks are being launched.

For the junior players, the frequency of the techniques used were more focused on middle level punch (25.17 %), face level punch (23.81 %) and front kick (17.69 %) only. Compared to the senior group, the middle level punch, face level punch and front kick were lower in frequency compared to the junior group and were 10 %, 16.67 % and 1 % respectively for those techniques. Karatekas are generally more inclined to score points by making use of fundamental punching techniques because the hands are much more agile than the feet in karate [8]. Therefore, the punching techniques are likely to be more frequently used during kumite attacks. Furthermore, punching techniques do not require a high degree of skill and are usually taught to karatekas from a very young age [11]. This could be why junior players prefer punching techniques more than kicking techniques. The other techniques (back kick, side snap kick, back fist strike, downward punch, lunge punch and reverse punch) were respectively low in frequency in both senior and junior groups.

Kicks are much more difficult to perform due to the technical requirements and the difficulty in generating a high amount of speed and power continuously during execution. Because of kicking techniques are difficult to perform successfully, young karatekas often revert to the simple punching techniques. Previously, a study that has been done to the female Shotokan karate junior athletes stated that arm techniques were the most frequent techniques used by the karatekas [9]. One previous study also stated that mawashi geri (roundhouse kick) and gyaku tsuki (reverse punch) were the most prevailed techniques used in attacks and counterattacks [12]. However, the result from our study contradicted the previous study as in ours the punching techniques that most prevailed were middle level punch, not the reverse punch.

The next finding of our study, was no significant difference in the overall efficiency of the attempted attacking techniques (front kick, roundhouse kick, back kick, side thrust kick, side snap kick, back fist strike, face level punch, middle level punch, downward punch, lunge punch and reverse punch) between senior and junior karate players' match ($p = 0.74$). However, if the techniques were compared individually between the groups, some of the techniques did show a difference in the efficiency (e.g. Front Kick with 0.04 in juniors versus 0.83 in seniors). Generally, the efficiency of the techniques attempted for both group of karatekas were the same between the groups even though the frequency and distribution of the variation of the techniques attempted by those groups of players were different.

Despite the difference in frequency of techniques attempted by seniors and juniors, (where the senior players attempted more frequent attacking techniques compared to the junior players) the efficiency did not differ as senior players used

both kicking techniques and punching techniques while the junior players mostly used punching techniques. In other words, even though kicking techniques could help in obtaining the higher score, the chances of attempting a good and successful kicking technique was low. A study was made on top-level senior female karate competitors of the elite world tournament, it was stated that there was no statistically significant difference between the arm and leg techniques in total situational efficiency [13].

Conclusions. The juniors will eventually progress to the senior group. Therefore, the result of this study might give a chance to all the karate practitioners especially to the coaches to make suitable changes to their methodology of training their athletes to give a better preparation the new generation of the juniors to reach the senior level, whether to be as strong as the current seniors or even better than them.

Future research perspectives. Future research can be dedicated to analyzing existing differences in training and competitive loads between elite junior and senior karate players. This may help assuring the smooth transition from juniors to seniors both in skills and other training components.

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ІНФОРМАЦІЯ ПРО АВТОРІВ

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